FORM PTO-1390 (REV. 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	
195.35	
U.S. APPLICATION NO. (If known, see 37 CFR 1.5)	
09/787342	

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE99/03000	20 September 1999 (20.09.99)	18 September 1998 (18.09.98)

TITLE OF INVENTION INFUSION PUMP COMPRISING A COMPUTER FOR CALCULATING THE RESPECTIVE MAXIMUM PERMISSIBLE DOSAGE

APPLICANT(S) FOR DO/EO/US TONNIES, Jan G.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND or SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [X] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [X] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [X] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [X] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [X] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [X] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [X] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [X] Other items or information:

Express Mail Certificate; Postcard; Declaration of Translation; English Translation of Article 34 Amended Claims; One Sheet of Formal Drawings

U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/787342	INTERNATIONAL APPLICATION NO. PCT/DE99/03000	ATTORNEY'S DOCKET NUMBER 195.35

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):

		CALCULATIONS PTO USE ONLY
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a (2)) paid to USPTO and International Search Report not prepared by the EPO or JPO	**$1000.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO	**$860.00**	
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	**$710.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(I)-(4)	**$690.00**	
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4)	**$100.00**	
ENTER APPROPRIATE BASIC FEE AMOUNT =		$ 1,000.00
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		$ 0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	7 -20 =	0	**x $18.00**	$ 0.00
Independent claims	1 -3 =	0	**x $80.00**	$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			**+ $270.00**	$ 0.00
TOTAL OF ABOVE CALCULATIONS =				$ 1,000.00
☒ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.			+	$ 500.00
SUBTOTAL =				$ 500.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ 0.00
TOTAL NATIONAL FEE =				$ 500.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.00
TOTAL FEES ENCLOSED =				$ 540.00
			Amount to be refunded:	$
			charged:	$

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 12-0551 in the amount of $ 540.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-0551. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

James E. Larson
LARSON & LARSON, P.A.
11199 - 69th Street North
Largo, FL 33773-5504
US / Customer No. 22497

SIGNATURE

James E. Larson
NAME

37,867
REGISTRATION NUMBER

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE:

APPLICANT: JAN G. TÖNNIES

GROUP ART UNIT:

U.S. S.N.:

EXAMINER:

U.S. FILING DATE:

ATTY. DOC. 195.35

INT. FILING DATE: SEPTEMBER 20, 1999

INT. S.N.: PCT/DE99/03000

EARLIEST PRIORITY DATE: SEPTEMBER 18, 1998

FOR: INFUSION PUMP COMPRISING A COMPUTER FOR CALCULATING THE RESPECTIVE MAXIMUM PERMISSIBLE DOSAGE

Box PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT TO §371 U.S. NATIONAL PHASE FILING

Sir:

Kindly make all of the amendments to the English language translation of the International Application as set forth in the substitute specification enclosed herein. These amendments, which are more fully described in the Remarks contained hereinbelow, include a request to insert certain headings and sub-headings which conform to USPTO specification procedure. Further, a request is hereby made to cancel all of the claims of the International Application (claims 1-5) and those of the original priority application (claims 1-6) and insert new claims 7-13. The substitute specification is

LARSON & LARSON,
ATTORNEYS
AT
LAW

11199-69th STREET N.
LARGO, FL 33773-5504
PH. 727-546-0660
FAX 727-545-1595

included since all amendments are made by way of inserting substituted pages. Accordingly, whereas the English language translation of the International Application includes pages 1-6 and a single sheet of substituted claims amended during Chapter II of the PCT under Article 34, the substituted specification includes pages 1-10.

Remarks

Applicant is filing a §371 U.S. National Phase utility patent application. Applicant encloses an English translated specification since the original PCT international priority application was filed in German. Applicant sets forth that nothing that could be construed as new matter was added to the application in preparing the English translation. Applicant encloses a "Verification of Translation" oath wherein the translator sets forth that to the best of his knowledge, the English specification is a true and complete translation of International Application PCT/DE99/03000.

Applicant makes amendments to the English translated specification merely to have the application comply with USPTO practice and procedure. In particular, Applicant has inserted the following headings: **Prior Applications** (with language identifying such prior applications), **Background of the Invention, 1. Field of Invention, 2. Description of the Prior Art, Summary of the Invention, Description of the Drawings** and

LARSON & LARSON, ATTORNEYS AT LAW

11199-69th STREET N.
LARGO, FL 33773-5504
PH. 727-546-0660
FAX 727-545-1595

Detailed Description of the Preferred Embodiment. Applicant has further added "preamble" language directly underneath the **Claims** heading found on page 8 of the substitute specification. Applicant respectfully points out that none of the aforementioned amendments could be construed as the introduction of new matter.

Applicant has canceled all of the original filed claims 1-6 of the priority application and all of the international application claims 1-5 from the English translated specification and has substituted a new set of claims numbered 7-13 found on pages 8-9 of the substitute specification. This was done to eliminate "multiple dependent" claim language used in the priority and international application and to place the claims in a form that complies with USPTO procedure. Applicant respectfully requests that the filing fee be calculated based upon the new set of claims numbered 7-13 wherein <u>no multiple dependent claims</u> are used, less than twenty (20) total claims are included with only one independent claim and the applicant is a small entity. Again, nothing in the new set of claims could be construed as the introduction of new subject matter.

Applicant finally wishes to point out that the aforementioned amendments, and in particular the addition of the new set of claims, was done to better encompass the full

LARSON & LARSON,
ATTORNEYS
AT
LAW

11199-69th STREET N.
LARGO, FL 33773-5504
PH. 727-546-0660
FAX 727-545-1595

scope and breadth of the invention. Notwithstanding, Applicant believes that the claims of the international application would have been allowable as amended. Accordingly, Applicant asserts that no claims in the substituted specification have been narrowed within the meaning of *Festo Corp. Shoketsu Kinzoku Kogyo Kabushiki Co.*, No. 95-1066, 2000 WL 1753646 (Fed Cir. Nov. 29, 2000).

Respectfully Submitted,

LARSON & LARSON, P.A.

James E. Larson
Attorney for Applicant
Reg. No. 37,867

LARSON & LARSON,
ATTORNEYS
AT
LAW

11199-69th STREET N.
LARGO, FL 33773-5504
PH. 727-546-0660
FAX 727-545-1595

JEL:jl
U:\Jim\WORK\PATENTS\PREAMEN8.195

Substitute Spec.

INFUSION PUMP COMPRISING A COMPUTER FOR CALCULATING THE RESPECTIVE MAXIMUM PERMISSIBLE DOSAGE

Prior Applications

This application is a §371 U.S. National Phase application which bases priority on International Application No. PCT/DE99/03000, filed September 20, 1999, which in turn bases priority on German Application No. DE 198 42 722.0 filed September 18, 1998.

Background of the Invention

1. Field of Invention

The invention relates to an infusion pump for the delivery of a quantity of medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the maximum permitted delivery quantity as a function of the previously delivered quantity and a blocking device for preventing further medicament delivery on exceeding a predetermined, permitted maximum value.

2. Description of the Prior Art

Such infusion pumps are used for supplying a patient with a medicament over a long time period and the medicament quantity continuously delivered by the infusion pump corresponding to the needs of the patient can be adjusted.

DE 33 90 462 C2 discloses an implantable infusion pump

equipped with a computer, which determines the medicament quantity delivered over a "sliding time window/slot," e.g. over three hours and blocks further delivery if the quantity delivered over this time period exceeds a maximum value.

However, this procedure is inadequate and the sliding time window length random. In many cases, such as e.g. with an attack of pain, it is necessary to briefly considerably raise the quantity of active substance to be delivered by the pump in order to rapidly raise the active substance level. However, whereas a quantity distributed over three hours can be tolerated, this can prove toxic when administered over three minutes. However, an infusion rate allowed when distributed over three hours, can prove toxic or even lethal when the administration extends beyond three hours. This problem cannot be solved with the "sliding time window."

The problem of the invention is to provide an implantable infusion pump making it possible to reliably determine in each case the allowed delivery quantity.

Summary of the Invention

According to the invention this problem is solved in that the computer determines the quantity or concentration of the active substance in the body of the patient on the basis of the medicament quantity delivered and its breaking down in the body

and compares it with the predetermined maximum value.

A preferred embodiment is characterized in that the computer is provided with a memory storing a quantity resulting from the adding up of the delivered quantity in each case and a subtraction of the percentage of the quantity entered in the memory resulting from the expected breaking down of the medicament in the body, as well as a comparator which constantly compares the quantity entered in the memory with the predetermined, permitted maximum value.

The maximum value at which blocking takes place is consequently not, as in the case of the prior art, a value averaged out over a given time window, but is in the form of the integral reduced by the amount resulting from the half-life of the medicament over the total quantity delivered.

The computer is preferably provided with a device which, either with a time interval predetermined in accordance with the expected breaking down of the medicament in the body, brings about the subtraction of a specific percentage of the quantity entered in the memory, or in the case of a fixed, predetermined time intervals brings about the subtraction of a percentage of the quantity entered in the memory corresponding to the expected breaking down of the medicament.

In the case of the proposed construction of the infusion

pump it is ensured that the administration of the medicament, which is brought about by means of the control device by the doctor or optionally also the patient, does not exceed a maximum permitted value.

In order to adjust the device for a given patient, it is merely necessary to input the half-life of the medicament to be administered and the individually permitted maximum value (toxic threshold).

It is obvious that the device must also be programmed in such a way that the lower minimum value (action threshold) is maintained.

The pump can be an implantable infusion pump. It is also possible to place the computer (or an additional, parallel-operating computer) in an external control device. It is possible for a bolus administration (namely an infusion of the medicament which in the case of long-term administration would lead to the toxic threshold being exceeded) only being possible in the case of electromagnetic coupling with the control device.

Description of the Drawings

The invention is described in greater detail hereinafter relative to the drawing wherein:

Fig. 1 shows, in the lower graph, an infusion profile and,

in the upper graph, the pattern resulting from this infusion profile of the quantity entered in the memory, the expected quantity (and therefore the concentration) of the active substance in the body of the patient, as well as the predetermined, permitted maximum value (threshold S).

Detailed Description of the Preferred Embodiment

In the case of the infusion profile shown there is initially a long-term administration with a relatively low infusion rate. As from time t1 to t2 (caused by the patient or doctor) a first bolus administration takes place, i.e. a brief administration with a high infusion rate, such as is e.g. necessary if the patient suffers an acute attack. At time t3 switching to a higher infusion rate takes place. At time t4, using the control device, the administration of a bolus is brought about which, on reaching the predetermined threshold S is prematurely stopped at time t5 by the computer. At time t6 the user attempts to set a bolus administration, which is stopped at time t6 because the threshold S has been reached.

The path of the active substance concentration in the body of the patient resulting from this infusion profile and which is essentially proportional to the active substance quantity present in the body is shown in the lower graph.

The pattern of the active substance concentration is

represented by a time integral over the infused quantity, reduced by the breaking down resulting from the half-life of the substance, i.e. as a function with a linear term determined by medicament administration and a negative exponential term determined by the medicament braking down rate.

In the drawing, this leads up to time t1 to a constant path, because here the quantity supplied precisely corresponds to the quantity broken down by the body. The administration of the bolus at time t1 leads to a steep rise in the active substance concentration. At the end of bolus administration at time t2 the concentration continuously drops, because the supplied active substance quantity is lower than the broken down quantity. After doubling the infusion rate at time t3 the concentration constantly rises, but with a shallower rise.

The bringing about of a further bolus administration through the user or doctor at time t4 leads to a concentration rise up to the threshold at time t5, which at time t6 leads to an automatic termination of bolus administration by the computer. The attempt at time t7 to bring about a further bolus administration is immediately prevented by the computer due to the immediate reaching of the threshold.

The path of the active substance concentration is simulated in the computer of the implantable infusion pump

(which can also be located in the control device).

In predetermined time intervals, e.g. every 10 sec, the quantity entered in the memory of the infusion pump is increased by a quantity corresponding to the amount delivered by the infusion pump in this time period. Furthermore, a mathematically determined percentage of the quantity entered in the memory is subtracted from the half-life of the delivered medicament, the resulting quantity is stored as the actual value. Alternatively, in time intervals given by the half-life (i.e. more frequently with a shorter half-life and less frequently with a longer half-life), the amount delivered in this time period can be summed and a fixed quantity subtracted.

The value entered in the memory consequently always corresponds (due to the not precisely determinable half-life this is naturally only approximately) to the actual amount in each case or concentration of the active substance in the body of the patient, whilst taking account of the breaking down thereof.

Claims

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

7. An infusion pump for the delivery of an amount of a medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the maximum permitted quantity to be administrated each time as a function of any previously delivered quantity and the expected breaking down rate of the medicament, the pump further being provided with a blocking device for preventing further administration of the medicament on exceeding a predetermined, permitted maximum value, the infusion pump comprising:

a) the computer having a memory in which is stored a quantitative figure resulting from a summation of a total delivered medicament amount and a subtracting of a percentage of a quantity entered in the memory resulting from an expected breaking down of the medicament in the body, and

b) the computer having a comparator which constantly compares the quantity entered in the memory with a predetermined, permitted maximum value.

8. The infusion pump according to claim 7, further comprising a device which, with a predetermined time interval

corresponding to the expected breaking down of the medicament in the body, can subtract a fixed percentage of the quantity entered in the memory.

9. An infusion pump according to claim 7, further comprising a device which with fixed, predetermined time intervals brings about a subtraction of a percentage of the quantity entered in the memory corresponding to the expected breaking down of the medicament.

10. An infusion pump according to claim 8, wherein the infusion pump is implantable within the body of the patient and can be operated by an external control device.

11. An infusion pump according to claim 10, wherein a first computer operates the infusion pump and a second computer operates the external control device.

12. An infusion pump according to claim 9, wherein the infusion pump is implantable within the body of the patient and can be controlled by an external control device.

13. An infusion pump according to claim 12, wherein a first computer operates the infusion pump and a second computer operates the external control device.

INFUSION PUMP COMPRISING A COMPUTER FOR CALCULATING THE RESPECTIVE MAXIMUM PERMISSIBLE DOSAGE

Abstract

Infusion pump for the delivery of a quantity of a medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the maximum permitted administration quantity for each case as a function of the previously delivered quantity and with a blocking device for preventing further administration of the medicament on exceeding a predetermined, permitted maximum value, in which the computer determines the quantity or concentration of the active substance in the body of the patient resulting from the delivered medicament quantity and its breaking down in the body and compares it with the predetermined maximum value.

INFUSION PUMP WITH A COMPUTER FOR CALCULATING THE MAXIMUM PERMITTED DELIVERY QUANTITY

The invention relates to an infusion pump for the delivery of a quantity of medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the maximum permitted delivery quantity as a function of the previously delivered quantity and a blocking device for preventing further medicament delivery on exceeding a predetermined, permitted maximum value.

Such infusion pumps are used for supplying a patient with a medicament over a long time period and the medicament quantity continuously delivered by the infusion pump corresponding to the needs of the patient can be adjusted.

DE 33 90 462 C2 discloses an implantable infusion pump equipped with a computer, which determines the medicament quantity delivered over a "sliding time window/slot", e.g. over three hours and blocks further delivery if the quantity delivered over this time period exceeds a maximum value.

However, this procedure is adequate and the sliding time window length random. In many cases, such as e.g. with an attack of pain, it is necessary to briefly considerably raise the quantity of active substance to be delivered by the pump in order to rapidly raise the active substance level. However, whereas a quantity distributed over three hours can be tolerated, this can prove toxic when administered over three minutes. However, an infusion rate allowed when distributed over three hours, can prove toxic or even lethal when the administration extends beyond three hours. This problem cannot be solved with the "sliding time window".

The problem of the invention is to provide an implantable infusion pump making it possible to reliably determine the in each case allowed delivery quantity.

According to the invention this problem is solved in that the computer determines the quantity or concentration of the active substance in the body of the patient on the basis of the medicament quantity delivered and its breaking down in the body and compares it with the predetermined maximum value.

A preferred embodiment is characterized in that the computer is provided with a memory storing a quantity resulting from the adding up of the in each case delivered quantity and a subtraction of the percentage of the quantity entered in the memory resulting from the expected breaking down of the medicament in the body, as well as a comparator which constantly compares the quantity entered in the memory with the predetermined, permitted maximum

value.

The maximum value at which blocking takes place is consequently not, as in the case of the prior art, a value averaged out over a given time window, but is in the form of the integral reduced by the amount resulting from the half-life of the medicament over the total quantity delivered.

The computer is preferably provided with a device which, either with a time interval predetermined in accordance with the expected breaking down of the medicament in the body, brings about the subtraction of a specific percentage of the quantity entered in the memory, or in the case of fixed, predetermined time intervals brings about the subtraction of a percentage of the quantity entered in the memory corresponding to the expected breaking down of the medicament.

In the case of the proposed construction of the infusion pump it is ensured that the administration of the medicament, which is brought about by means of the control device by the doctor or optionally also the patient, does not exceed a maximum permitted value.

In order to adjust the device for a given patient, it is merely necessary to input the half-life of the medicament to be administered and the individually permitted maximum value (toxic threshold).

It is obvious that the device must also be programmed in such a way that the lower minimum value (action threshold) is maintained.

The pump can be an implantable infusion pump. It is also possible to place the computer (or an additional, parallel-operating computer) in an external control device. It is possible for a bolus administration (namely an infusion of the medicament which in the case of long-term administration would lead to the toxic threshold being exceeded) only being possible in the case of electromagnetic coupling with the control device.

The invention is described in greater detail hereinafter relative to the drawing. The drawing shows in the lower graph an infusion profile and in the upper graph the pattern, resulting from this infusion profile, of the quantity entered in the memory, the expected quantity (and therefore the concentration) of the active substance in the body of the patient, as well as the predetermined, permitted maximum value (threshold S).

In the case of the infusion profile shown there is initially a long-term administration with a relatively low infusion rate. As from time t1 to t2 (caused by the patient or doctor) a first bolus administration takes place, i.e. a brief administration with a high infusion rate, such as is e.g.

necessary if the patient suffers an acute attack. At time t3 switching to a higher infusion rate takes place. At time t4, using the control device, the administration of a bolus is brought about which, on reaching the predetermined threshold S is prematurely stopped at time t5 by the computer. At time t6 the user attempts to set a bolus administration, which is stopped at time t6 because the threshold S has been reached.

The path of the active substance concentration in the body of the patient resulting from this infusion profile and which is essentially proportional to the active substance quantity present in the body is shown in the lower graph.

The pattern of the active substance concentration is represented by a time integral over the infused quantity, reduced by the breaking down resulting from the half-life of the substance, i.e. as a function with a linear term determined by medicament administration and a negative exponential term determined by the medicament breaking down rate.

In the drawing this leads up to time t1 to a constant path, because here the quantity supplied precisely corresponds to the quantity broken down by the body. The administration of the bolus at time t1 leads to a steep rise in the active substance concentration. At the end of bolus administration at time t2 the concentration continuously drops, because the supplied active substance quantity is lower than the broken down quantity. After doubling the infusion rate at time t3 the concentration constantly rises, but with a shallower rise.

The bringing about of a further bolus administration through the user or doctor at time t4 leads to a concentration rise up to the threshold at time t5, which at time t6 leas to an automatic termination of bolus administration by the computer. The attempt at time t7 to bring about a further bolus administration is immediately prevented by the computer due to the immediate reaching of the threshold.

The path of the active substance concentration is simulated in the computer of the implantable infusion pump (which can also be located in the control device).

In predetermined time intervals, e.g. every 10 sec, the quantity entered in the memory of the infusion pump is increased by a quantity corresponding to the amount delivered by the infusion pump in this time period. Furthermore a mathematically determined percentage of the quantity entered in the memory is subtracted from the half-life of the delivered medicament, the resulting quantity is stored as the actual value. Alternatively in time intervals given by the half-life (i.e. more frequently with a shorter half-life and

less frequently with a longer half-life), the amount delivered in this time period can be summated and a fixed quantity subtracted.

The value entered in the memory consequently always corresponds (due to the not precisely determinable half-life this is naturally only approximately) to the in each case actual amount or concentration of the active substance in the body of the patient, whilst taking account of the breaking down thereof.

CLAIMS

1. Infusion pump for the delivery of an amount of a medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the in each case maximum permitted administration quantity as a function of the previously delivered quantity and the expected breaking down rate of the medicament and with a blocking device for preventing further administration of the medicament on exceeding a predetermined, permitted maximum value, characterized in that the computer is provided with a memory in which is stored a quantity resulting from the adding up of the in each case delivered amount and subtracting the percentage of the quantity entered in the memory resulting from the expected breaking down of the medicament in the body and a comparator which compares the quantity entered in the memory constantly with the predetermined, permitted maximum value.

2. Infusion pump according to claim 1, characterized by a device which, with a predetermined time interval corresponding to the expected breaking down of the medicament in the body, the subtraction of a fixed percentage of the quantity entered in the memory.

3. Infusion pump according to claim 1, characterized by a device which with fixed, predetermined time intervals brings about the subtraction of a percentage of the quantity entered in the memory corresponding to the expected breaking down of the medicament.

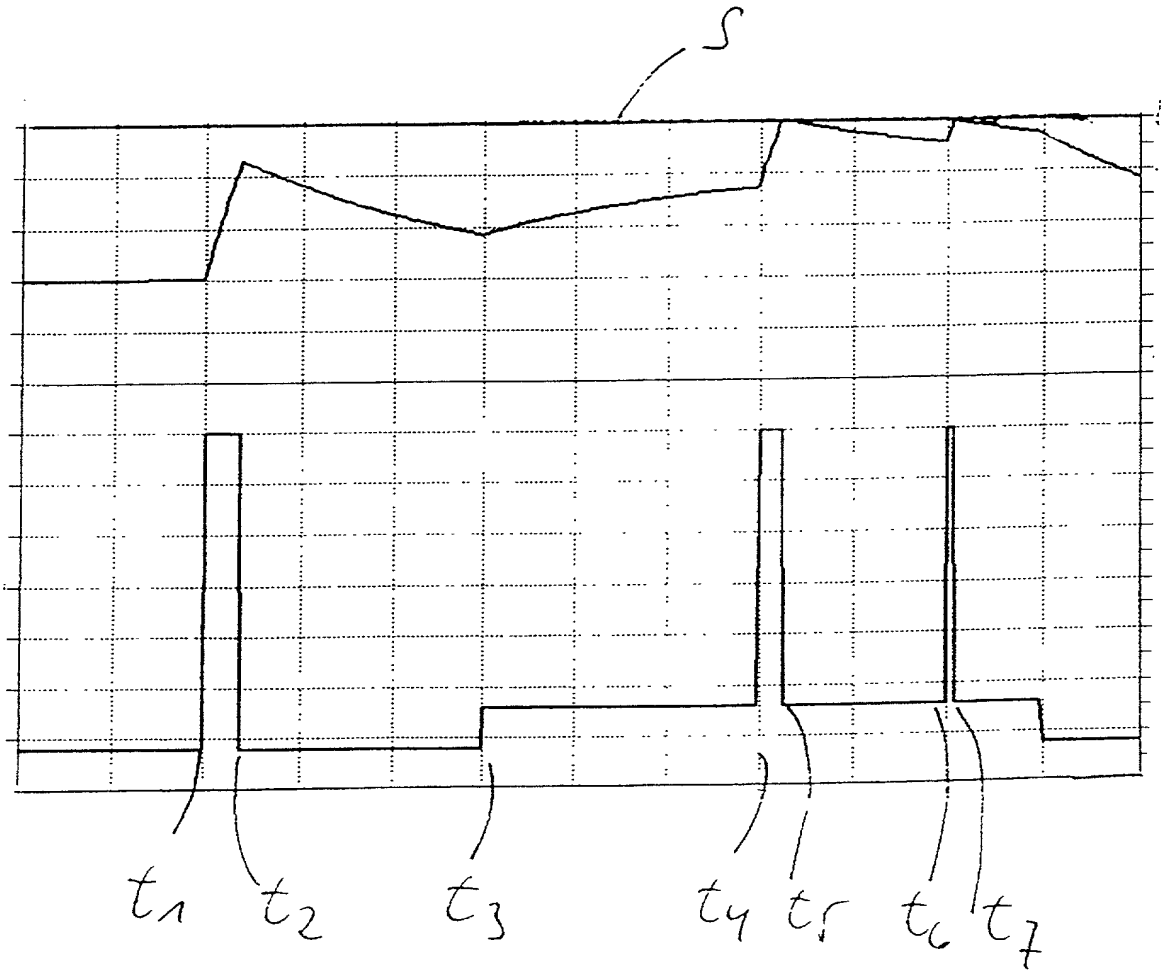
4. Infusion pump according to one of the preceding claims, characterized by its construction as an implantable infusion pump with an external control device.

5. Infusion pump according to claim 4, characterized by a first computer in the infusion pump and a second computer in the control device.

ABSTRACT

Infusion pump for the delivery of a quantity of a medicament to the body of a patient determinable by means of an electronic control device, the pump being provided with a computer for calculating the in each case maximum permitted administration quantity as a function of the previously delivered quantity and with a blocking device for preventing further administration of the medicament on exceeding a predetermined, permitted maximum value, in which the computer determines the quantity or concentration of the active substance in the body of the patient resulting from the delivered medicament quantity and its breaking down in the body and compares it with the predetermined maximum value.

Fig 1



Practitioner's Docket No. 195.35 *PATENT*

COMBINED DECLARATION AND POWER OF ATTORNEY

(ORIGINAL, DESIGN, NATIONAL STAGE OF PCT, SUPPLEMENTAL, DIVISIONAL, CONTINUATION, OR C-I-P)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is for a **national stage of PCT** application.

INVENTORSHIP IDENTIFICATION

My residence, post office address and citizenship are as stated below, next to my name. I believe that I am the original, first and sole inventor *(if only one name is listed below)* or an original, first and joint inventor *(if plural names are listed below)* of the subject matter that is claimed, and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

INFUSION PUMP COMPRISING A COMPUTER FOR CALCULATING THE RESPECTIVE MAXIMUM PERMISSIBLE DOSAGE

SPECIFICATION IDENTIFICATION

The specification is attached hereto.

ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information, which is material to patentability as defined in 37, Code of Federal Regulations, § 1.56.

PRIORITY CLAIM (35 U.S.C. § 119(a)-(d))

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

Such applications have been filed as follows.

PRIOR PCT APPLICATION(S) FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS APPLICATION AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119(a)-(d)

INDICATE IF PCT	APPLICATION NUMBER	DATE OF FILING DAY, **MONTH**, YEAR	PRIORITY CLAIMED UNDER 35 USC 119
PCT	**PCT/DE99/03000**	**20/09/1999**	**yes**
DE	**198 42 722.0**	**18/09/1998**	**yes**

POWER OF ATTORNEY

I hereby appoint the following practitioner(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

James E. Larson Registration Number 37,867

Herbert W. Larson Registration Number 21,008

I hereby appoint the practitioner(s) associated with the Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

SEND CORRESPONDENCE TO

James E. Larson
LARSON & LARSON, P.A.
11199 - 69th Street North
Largo, FL 33773-5504

Customer Number 22497

DIRECT TELEPHONE CALLS TO:

James E. Larson
(727) 546-0660

DECLARATION

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

SIGNATURE(S)

JAN G. TONNIES

Inventor's signature Jan G. Tonnies

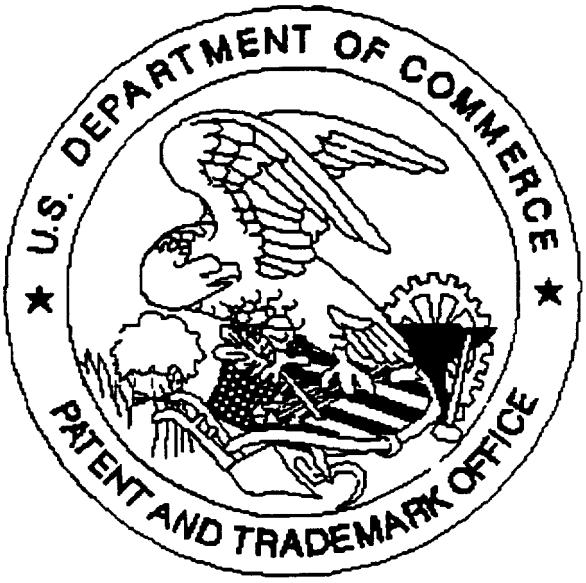
Date 30.1.01 **Country of Citizenship** Federal Republic of Germany

Residence Kiel, Federal Republic of Germany DE X

Post Office Address Niemannsweg 133
D-24105 Kiel
Federal Republic of Germany

United States Patent & Trademark Office

Office of Initial Patent Examination -- Scanning Division



SCANNED #22

Application deficiencies found during scanning:

☐ Page(s)_____of_____ were not present for scanning. (Document title)

☐ Page(s)_____of_____were not present for scanning. (Document title)

☑ ***Scanned copy is best available.***

Page one of Preliminary Amendment is torn.